NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

Underground Outlet

(Feet)

Code 620

DEFINITION

A conduit installed beneath the surface of the ground to collect surface water and convey it to a suitable outlet.

PURPOSES

To dispose of excess water from terraces, diversions, subsurface drains, surface drains, trickle tubes or principal spillways from dams (outside the dam area only), or other concentrations without causing damage by erosion or flooding.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- Excess surface water needs to be disposed.
- A buried outlet is needed for Diversions (362), Terraces (600), Water and Sediment Control Basin (638), or similar practices.
- An underground outlet can be installed that will safely dispose of excess water.
- Surface outlets are impractical because of stability problems, climatic conditions, land use, equipment traffic or other factors.

CRITERIA

Capacity. The underground outlet shall be designed, alone or in combination with other practices, with adequate capacity to insure that the terrace, diversion, or other practices function according to the standard for the specific practice.

For example, an underground outlet can be used in combination with a grassed waterway or a surface drain to carry part of the design flow. The capacity of the underground outlet for natural basins shall be adequate for the intended purpose without causing excessive damage to crops, vegetation, or improvements.

Inlet. Hydraulics. Underground outlets shall be continuous conduits, tubing, or tile. Joints shall be hydraulically smooth, and the materials and methods used shall be as recommended by the manufacturer. If a pressure system is used, joints shall be adequate to withstand the design pressure, including surges and vacuum. The maximum velocity must not exceed the safe velocity for the conduit materials and installations.

Lines shall be adequate to carry the design flow when the outlet and all inlets are operating at design capacity. Capacity shall be based on the pipe size as determined by design charts in EFM, Chapter 14, or on other flow-control devices to prevent water from the upper inlets from discharging through the lower inlets. The minimum conduit diameter shall be 4 inches. The minimum diameter of offset lines connecting inlets to conduits shall be 3 inches.

Materials shall meet or exceed the design requirements against leakage and shall withstand

internal pressure or vacuum and external loading. Plastic, concrete, aluminum, and steel shall meet the requirements specified in the irrigation water conveyance pipeline standards appropriate for the design internal pressure and external loading. All materials specified for Subsurface Drains (606) can be used for underground outlets. Conduits, however, can be perforated or nonperforated, depending on the design requirements.

Outlet. The outlet shall be sufficiently stable for all anticipated flow conditions. It shall be designed for maximum anticipated water surface at design flow. The outlet must be protected against erosion and undermining of the conduit, entry of tree roots, damaging periods of submergence, and entry of rodents or other animals into the underground outlet. The outlet pipe shall be equipped with a hinged type animal guard rather than a rigid screen or pins to allow passage of debris. A continuous section of rigid pipe without open joints or perforations will be used at the outlet end of the line and must discharge above the elevation of normal flow in the outlet ditch.

When discharging an underground outlet into a pond or lake, the minimum elevation of the pipe invert shall be at the normal level of pond or lake. When the outlet is located near an area of sediment deposition along the shoreline, the minimum elevation of the outlet pipe invert shall be at least 1.0 foot above the normal water elevation.

The outlet pipe and its installation will conform to the following requirements:

1. If burning vegetation on the outlet ditch bank is likely to create a fire hazard, the material from which the outlet pipe is fabricated must be fire resistant. If the probability is great, the outlet pipe must be fireproof.

2. If plastic pipe is used, it shall meet one of the following:

- Polyvinyl chloride (PVC) with SDR equal to 35 or less or schedule 40 or greater.
- High-density polyethylene (HDPE) ASTM-D3350 flexural modulus cell class 4 or greater, conforming to ASTM-F714 for smooth wall HDPE or AASHTO M-250 or M-294 for double wall HDPE pipe. The materials will typically have a standard dimension ratio value of 32.5 or less or pipe stiffness value of 34 psi or greater, respectively.

3. If corrugated metal pipe is used, it shall meet one of the following:

- Corrugated steel pipe will have a minimum thickness of 0.064 inches, conforming to ASTM A760, A762 and A885.
- Corrugated aluminum pipe will be riveted or helical fabrication with a minimum thickness of 0.069 inches, conforming to ASTM B745 and B790.

4. Two-thirds of the pipe shall be buried in the ditch bank and the cantilever section must extend to the toe of the ditch side slope or the side slope must be protected from erosion. The minimum length of the pipe will normally be 8 feet. For conduits 10 inches in diameter or greater, longer outlet sections shall be considered, such as:

- 10 inches and 12 inches in diameter, use 12 feet.
- 15 inches and 18 inches in diameter, use 16 feet.
- Use 20 feet outlet pipe for all diameters larger than 18 inches.

5. If ice or floating debris may damage the outlet pipe, the outlet shall be recessed to the extent that the cantilevered part of the pipe will be protected from the current in the outlet channel.

Protection. After the outlet is installed, all disturbed areas shall be reshaped and regraded so they blend with the surrounding land features and conditions. Visual resources must be given the same consideration as other design features. Areas that are not to be farmed or covered by structural works shall be established to vegetation or otherwise protected from erosion as soon as practicable after construction.

All conduits and underground appurtenances shall be installed deep enough to prevent damage from tillage equipment.

CONSIDERATIONS

Underground outlet should be part of the treatment needed to protect the soil, water, plant, animal and air resources. The management system must be planned to prevent excessive maintenance and operation problems.

The effects on water quantity and quality shall be considered. This practice will normally have a negligible effect on the quantity of surface and ground water. However, the effects on (1) the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge, and (2) the volume of downstream flow that might cause environmental, social or economic effects should be addressed.

This practice will effect the water quality by (1) decreasing sediment delivered to the receiving waters by reducing gully and channel erosion, (2) reducing the amount of soluble substances which percolate toward the ground water and (3) delivering any substance which enters the underground outlet to the receiving waters by limiting opportunity for substance attenuation by degradation, filtering, or absorption. Also, the effect of water quality on the visual quality of downstream water resources and wetland or water related habitats should be considered.

Special attention shall be given to maintaining and improving visual resources and wildlife habitat where applicable. The landowner/user will be advised if wetlands will be affected and that USDA-NRCS wetland policy will apply. All work planned shall be in compliance with General Manual Title 450-GM, Part 405, Subpart A, Compliance With Federal, State and Local Laws and Regulations. If archaeological or historical properties are encountered, the USDA policy in General Manual Title 420-GM, Part 401 shall be followed.

PLANS AND SPECIFICATIONS

General. Construction operations shall be carried out in such a manner and sequence that erosion and air and water pollution will be minimized and held within acceptable limits. Construction methods that enhance wildlife will be used where practical. Trees, stumps, and brush removed from the construction area may be piled for wildlife habitat when approved by the landowner/user.

The competed job shall present a professional appearance and shall conform to the line, grades, and elevations shown on the drawings or as staked in the field and according to manufacturer's recommendations.

All operations shall be carried out in a safe and skillful manner. Safety and health regulations shall be observed and appropriate safety measures used.

Materials. Materials for underground outlets shall meet the requirements shown in the plans. They shall also be field inspected for any deficiencies such as thin spots and cracking prior to installation.

Inlets may be manufactured inlets or fabricated from plastic or metal according to the following requirements:

- Plastic pipe: Polyvinyl chloride (PVC) or high-density polyethylene (PE) pipe with SDR equal to 35 or less or schedule 40 or greater.
- Metal pipe: Smooth steel pipe with 3/16" minimum wall thickness or 16 gage or 0.06 inch thickness corrugated metal pipe (galvanized steel or aluminum).

Fabrication. Inlet holes shall be smooth and burr free. Holes shall not remove more than 50 percent of material in any horizon or vertical row of holes. For inlets fabricated from metal or smooth plastic, 1" x 4" slots may be used in lieu of ¾" or 1" diameter holes as long as the openings provide an adequate cross-sectional area.

Holes larger than 5/16" diameter that are more than 6 inches below the channel bottom shall be covered with plastic, fiberglass, nylon, gravel, or other filter material to prevent soil from entering the inlet.

Other combinations of the number and size of holes may be used if they provide the necessary openings. Other materials and methods of fabrication may be used for the inlet, tee and other appurtenances as long as the functional capabilities of the inlet are satisfied.

Orifices. Trench excavation. Trench excavation shall be sufficient to provide required cover after other grading is completed. The cover over all conduit lines except metal pipe shall be 24 inches or more. The cover over metal pipes shall be 12 inches or more.

The bottom of the trench shall be grooved in the center for conduit bedding. The trench width will be a minimum of 3 to 6 inches on both sides of the conduit. Maximum trench width shall be 24 inches measured 12 inches above top of conduit for conduits less than 12 inches. Minimum trench width shall be conduit diameter plus 6 inches except when the trench is shaped to fit the conduit; additional width is not required.

Installation. Conduit lines shall be installed and properly backfilled prior to placement of earthfill for the storage basin or terrace ridge.

Provide at least 2 inches of compacted earth or sand filter bedding when the conduit line is to be installed in a rock trench or where rock is exposed in the trench bottom.

Conduit lines shall be joined with standard factory couplers, if applicable, to produce a continuous system. Internal couplers may be used if they do not cause flow restrictions. Conduit ends shall be protected during installation.

All appurtenant structures, including trash and animal guards, shall be installed promptly and provisions shall be made for protecting them during installation. All conduit ends except the outlet and inlets shall be capped with standard factory end caps or concrete. When corrugated plastic tubing is used, no more than 5 percent stretch will be allowed.

Construction tolerances. The following are guidelines for underground outlet construction:

Conduit

Flowline or grade + 0.1 foot
There will be no reverse grades.

Trench backfill. Conduits shall be bedded and backfilled throughout the base width of the basin embankment or terrace ridge. Friable soil material shall be placed in 6-inch layers and compacted to a depth of 18 inches. The sides of the remaining trench shall be sloped no steeper than 1 horizontal to 1 vertical and backfill placed in 6-inch layers and compacted. Mechanical compaction, water packing or other means of compacting shall be use.

The remaining conduit shall be blinded and backfilled in accordance with Subsurface Drain (606).

Finish. Work areas shall be restored to their former condition. Vegetation or other protective cover shall be established promptly in accordance with practice standard Critical Area Planting (342)

OPERATION AND MAINTENANCE

A maintenance program shall be established by the landowner/user to maintain the functional capacity of the underground outlet. Maintenance needs are to be discussed with the landowner/user who is responsible for maintaining the practices installed with NRCS assistance. Items to consider are:

1. Keep inlets, trash guards, collection boxes and structures clean and free of materials that can reduce the flow.
2. Repair all broken or crushed lines to insure proper functioning of the conduit.
3. Repair or replace broken or damaged inlets damaged by livestock or farm machinery.
4. Periodically inspect outlet conduit and animal guards for proper functioning.
5. Redistribute sediment buildup so the inlet is in the lowest place.